

Cockatoo Grass *Alloteropsis semialata* as a keystone species in northern Australia

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Introduction

There are two main ways for a grass species to survive the long dry season typical of the monsoonal tropics of Australia. The first strategy is to be short-lived, but produce thousands of seeds capable of lasting at least six months exposed on, or shallowly-buried in, baking-hot soils. Annual or ephemeral grasses generally shed their seeds in the transition between the wet and dry seasons, dormant and well-encased in fibrous spikelets. After their defences have been broken by repeated tumbling and heating and cooling through the dry season, they are ready to soak up the first wet season rains and germinate (Andrew & Mott 1983; Crowley & Garnett 1999). The main risk of this strategy is of too many seeds germinating and then dying if there is a false start to the wet season. To counter this, annual grasses pour all their resources into producing copious numbers of seeds, so a few always get through. Annual grasses such as Annual Sorghum *Sorghum intrans* and Fire Grass *Setiglycerium fragile* dominate much of the northern Australian savannas. As a result, the dry season begins as a time of plenty for seed-eating birds. As the dry season progresses, seed abundance declines as a result of fire, seed burial and predation of seeds by granivores (Tothill 1969; Crowley & Garnett 1999).

In contrast, the perennial grasses of northern Australia produce fewer seeds, generally at the start of the dry season (Tothill 1977; Mott 1978). As the soil dries out, perennial grasses store most of their resources underground. This second strategy, of persisting as dormant plants rather than seeds, means that existing plants can take advantage of the first wet season rains. In this case, false starts to the wet season are a boon, giving resprouting perennials an extra advantage over seedlings struggling to establish. This strategy is typified by the bulky perennial grasses Plume Sorghum *Sorghum plumosum* and Black Spear Grass *Heteropogon contortus*. These grasses can form a dense sward to the exclusion of smaller plants, but they are overtaken by annual grasses where the soils are too poor to support a continuous grass layer, or where the ground cover is more substantially disturbed by fires or grazing.

Cockatoo Grass

Cockatoo Grass *Alloteropsis semialata*, found through northern and north-eastern Australia (Figure 1), has a completely different strategy (Table 1). This small-statured perennial (Figure 2) is unable to compete with the bulkier perennial grasses (Walker *et al.* 1997). Instead, it focuses its growing phase into the very early wet season before other perennial grasses reach a competitive size. So Cockatoo Grass is the first grass of the northern savannas to sprout after rain, no matter how early the rains fall. Before the end of the wet season, Cockatoo Grass shoots are already dying back, storing up new fleshy basal shoots ready to sprout at the start of the next wet.

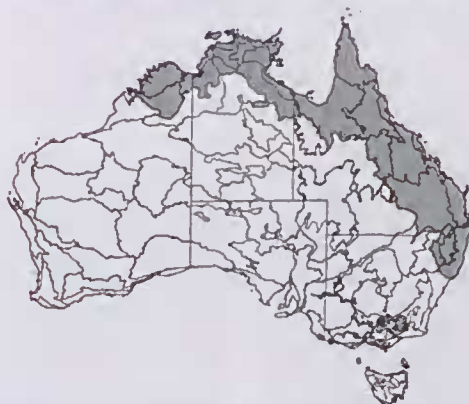


Figure 1. Australian bioregional distribution of Cockatoo Grass, based on herbarium collections. The species may occur as isolated populations outside the indicated range.

Table 1. Characteristics of Cockatoo Grass.

Name	Cockatoo Grass <i>Alloteropsis semialata</i> (R.Br.) Hitchcock
Distribution	Eastern Africa, Tropical Asia and Australia (see Figure 1)
Soils	Prefers acid, sandy, usually well-drained soils that may be seasonally saturated
Climate	Monsoonal, summer dominant rainfall (600-1600 mm/year in Australia)
Reproduction	Seeds and reproductive tillering
Habit	Perennial tufted grass, dormant over the dry season
Size	0.3 – 1.2 m high
Flowering	October to April (McFarlane 1992); approximately six weeks after the first rains (Crowley & Garnett 2001)
Inflorescence	Two to five (usually three) racemes of overlapping spikelets with ciliate margins that flare when seeds are fertilised
Seeds	Can germinate immediately after seed fall; viability lost within six months. Ephemeral seed bank (Crowley & Garnett 2001)

Cockatoo Grass also seeds early in the wet season. Within six weeks, its three-pronged inflorescences have already shot (Figure 3). Not being dormant, the seeds are ready to germinate as soon as they fall (Crowley & Garnett 2001). Because Cockatoo Grass grows, seeds and dies back earlier than most other grasses, its leaves and seeds provide food at a period of scarcity in the early wet season, and its fleshy basal shoots (Figure 4) a staple diet through the dry season.

At the start of the wet season, when most grass seeds germinate, seed-eating birds are faced with a shortage of food. As soon as they are produced, Cockatoo Grass seeds become an important food for parrots and finches, which take the seeds both from the stem (Garnett & Crowley 1994, 1995) and after they fall (S. Legge, pers. comm.). In many places where Cockatoo Grass grows, few other large-seeded grasses produce seed at the same time (Garnett & Crowley 1995), although Golden Beard Grass or Ribbon Grass *Chrysopogon fallax*, with a similar life cycle, also produces seed at this time of the year (Garnett & Crowley 1995). On Cape York Peninsula, seeding of Cockatoo Grass marks the end of food scarcity, and the start of breeding activity by Golden-shouldered Parrots *Psephotus chrysopterygius* (Crowley *et al.* 2004). Cockatoo Grass seeds are also eaten by Brush-tailed Rabbit-rats *Conilurus penicillatus* (Firth *et al.* 2005). In a study on Cape York Peninsula, most of the seeds that reached the ground without being eaten by birds or mammals were taken by ants (Crowley & Garnett 2001). With this level of predation, regeneration of Cockatoo Grass from seed is likely to be a rare event, so it is all the more important for plants to survive the dry season.



Figure 2. Cockatoo Grass in Golden-shouldered Parrot nesting habitat. (Gabriel Crowley)



Figure 3. Cockatoo Grass in flower. (Stephen Garnett)

As soon as Cockatoo Grass begins to shoot early in the wet season, cattle seek out its tender green shoots, which are also a preferred food of the Pale Field Rat *Rattus tunneyi* through much of the year (Braithwaite & Griffiths 1996). Cattle certainly reduce plant vigour and seed production, and if left to graze unchecked in the wet season, could eliminate Cockatoo Grass from pastures. In most places, Cockatoo Grass has a reputation as being poor quality forage with a low selection preference by cattle (Petheram & Kok 1986) and buffalo (Abeare 2004). This is because palatability is typically assessed late in the growing season, when Cockatoo Grass plants have already started to cure: digestibility declines faster in Cockatoo Grass than it does in most other perennial grasses (Eggington 1986). In fact, when newly sprouted, Cockatoo Grass is one of the most nutritious perennial grasses in the savannas (Eggington 1986; O'Reagain *et al.* 1995). Its young shoots are not only important forage for domestic cattle grazing, but also for wild cattle, including the Tamarau *Bubalus mindorensis* of the Philippines (Talbot & Talbot 1966).



Figure 4. The nutritious base of Cockatoo Grass. (Gabriel Crowley)



Figure 5. Chewed and regurgitated Cockatoo Grass. (Gabriel Crowley)

Having to survive long periods as dormant plants also means Cockatoo Grass provides animals with a rich store of underground food (Figure 5). Its fleshy stem bases are one of the main food sources for northern Australian bettongs and bandicoots (McIlwee & Johnson 1998), and are relied upon by the Northern Bettong *Bettongia tropica* in the late dry season and during extended dry periods when truffles are scarce (Abell *et al.* 2006). The stem bases are also the principal food of Common Mole-rats *Cryptomys hottentotus* in Africa (Genelly 1965) and are eaten by Common Wallaroos *Macropus robustus* (Telfer & Garde 2006). Pigs also seek out the grasses, digging up whole plants to feed on the tiller bases (Crowley *et al.* 2004).

Conclusions and recommendations

Cockatoo Grass fills an important role in the tropical savannas of Australia and elsewhere, providing food for seed-eating birds and small mammals, often at times when other foods are scarce or difficult to obtain. It can be considered a “keystone” species for at least two animal species that rely on it to survive when other foods are unavailable, the Golden-shouldered Parrot (Crowley *et al.* 2004) and Northern Bettong (Abell *et al.* 2006). Cockatoo Grass is also highly susceptible to overgrazing by pigs and cattle. Protection of healthy stands of Cockatoo Grass is therefore important for the conservation of biodiversity in the Australian savannas. While exclusion of cattle and pigs from important stands will allow the greatest development of plants and maximise seed production, healthy stands can also persist under recommended best practice pastoral management for Australian rangelands. This includes spelling native pastures from cattle grazing in the early wet season, and light to moderate pasture utilisation rates (Hunt 2003). In some circumstances, disturbance from fire may also be beneficial in allowing the species to compete with more vigorous grasses (Walker *et al.* 1997; Crowley & Garnett 2001; B. Bateman, pers. comm.).

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